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Remarks on Sichuan Wood Owl *Strix uralensis davidi* from observations in south-west China

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Sichuan Wood Owl (Père David's Owl) *Strix uralensis davidi* was described, by Sharpe (1875) as *Syrnium davidi*, from the type, a male, taken at Mupin, in Sichuan province, China, and named for the French missionary, Armand David, who discovered this owl during his first collecting trip to western China, in 1866. (J. Verreaux labelled the specimen *Ptynx fulvescens*, considering it to be an example of the rufous subspecies of Ural Owl, known from Japan (now *Strix uralensis fuscescens*), but in older literature it also acquired the synonym *Syrnium rufescens*. This led to much confusion, as *Strix fulvescens* (previously *Syrnium fulvescens* Sclater & Salvin) is a quite different owl species from Middle America, as Sharpe (1875) had already noted.) Even now, our knowledge of Sichuan Wood Owl's distribution, ecology, reproduction, voice and behaviour is very poor. Consequently, data on status, conservation and taxonomy are rather vague (Holt *et al.* 1999, König *et al.* 1999). Most descriptions of this owl and its taxonomy are traceable to observations and specimens from the late-19th and early-20th centuries. Published distribution maps are still, of necessity, rather vague, but this owl is known to inhabit primeval forests in montane Sichuan and south-east Qinghai (Cheng Tso-hsin 1987), and although not previously known from Gansu (Liu Naifa 1995), where this owl was first detected in 1995 (Sun *et al.* 2001), recent records indicate that it occurs in extensive woodland across southern Gansu, as far as the border with

Sichuan (Y. H. Sun pers. comm.). Given that its range appears limited to high-elevation coniferous forests in western China and eastern Tibet, this owl is considered a relict of most recent glacial events (Voous 1962).

Sichuan Wood Owl has always been considered rare (Weigold *in* Stresemann 1923, Holt *et al.* 1999), and in China is listed in category II of the list of nationally threatened species (Zheng Guangmei & Wang Qishan 1998). Its isolation and apparent rarity might mean that it demands listing as globally threatened, as Vulnerable (Collar *et al.* 1994), but subsequently BirdLife International (2000) elected to treat *davidi* as a subspecies, consequently its global conservation status has not been evaluated since. Availability of suitable habitat is strictly limited through fragmentation of old-growth coniferous forests due to the natural morphology of the mountains, as well as extensive clear-cutting and grazing over much of montane Sichuan, especially the eastern Qinghai-Tibetan plateau, in the 1970s (Liu Naifa pers. comm.). Nowadays, the country is starting to maintain its woodland areas and encourage reforestation (in response to increasing erosion and flooding), and recently, China's ministry for land use and environment decreed a logging ban for nearly all montane forests, in some areas even for bamboo cutting, especially in watersheds. Furthermore many reserves have been declared, some with a status comparable to national parks (e.g. Jiuzhaigou Reserve), others as strict reserves, accessible only by permit.

Study area

Lianhuashan Nature Reserve (34°56'–58'N, 103°44'–48'E) is in Gansu province, south of the capital Lanzhou, at the east edge of the Qinghai-Tibetan Plateau. The reserve is named after a conspicuous rock summit, at nearly 3,500 m, visited by thousands of Buddhist pilgrims annually. Covering *c.*120 km^2, the reserve includes dry south-facing slopes with thickets of buckthorn, willow, wild rose, and scattered firs, as well as alpine meadows and, on shaded slopes, moist coniferous forest, rich in gaps dominated by fir and spruce, with bamboo, wild rose, birch, mountain ash, many bushes and, at higher elevations, rhododendron. Of the total reserve area, non-fragmented woodland covers *c.*47 km^2, and the treeline is above 3,000 m. Due to heavy logging in the 1970s, stands of old-growth forest persist only on very steep slopes, exposed ridges, and within inaccessible canyons. Following designation as a nature reserve in 1983, human utilisation has been restricted to yak grazing, seasonal bamboo cutting and some logging. Bird species include Chinese Grouse *Bonasa sewerzowi*, Blood Pheasant *Ithaginis cruentus*, Blue Eared Pheasant *Crossoptilon auritum*, Ring-necked Pheasant *Phasianus colchicus*, Chestnut-throated Partridge *Tetraophasis obscurus*, Black Woodpecker *Dryocopus martius*, Golden Eagle *Aquila chrysaetos*, Lammergeier *Gypaetus barbatus*, Eagle Owl *Bubo bubo* and Tengmalm's Owl *Aegolius funereus beickianus*. Lianhuashan Nature Reserve represents an impressive relict of natural woodland in montane south-west China.

Satellite data have permitted maps of the actual distribution of forest to be drawn, which can be used to plan reforestation and the creation of corridors between remnant forest patches (Klaus *et al.* 2001). Through a grant from the BP Conservation Programme, suitable nest boxes for the owl were erected in the reserve in 2002–03, providing nesting sites even in younger forest stands, and also affording possibilities for observing the reproductive cycle.

In April–May 1995, May–June 1997 and June–July 1999 I made field observations and tape-recordings of at least one pair of Sichuan Wood Owls in the reserve. I also made simple tests of the responsiveness of these owls to my imitation of the territorial song of Ural Owl from Europe, both to test the response of previously silent owls and to determine the reaction of owls already engaged in territorial display. Though preliminary, my observations provide new information on the behaviour of this owl and, in particular, analysis of the vocalisation data permits comparison with the vocal repertoire of other forms of Ural Owl with which I am reasonably familiar.

Description

Field observations were mostly made in the twilight hours, but on 13 April 1995, I discovered a male in daylight (Fig. 1). A detailed description was obtained from a specimen taken in the reserve and retained in a small museum at the reserve administration building. Although poorly mounted, it clearly has blackish-brown scapulars with distinct white dots, a long tail with its central feathers a near-uniform blackish brown and barely marked (Fig. 2a), rather coarse longitudinal underparts

Figure 1. Adult Sichuan Wood Owl *Strix uralensis davidi* (Wolfgang Scherzinger)

Figure 2a (top). Specimen of Sichuan Wood Owl *Strix uralensis davidi* from Lianhuashan reserve. The overall dark coloration of the upperparts and scapulars, and the virtually unmarked central tail feathers, are visible (Wolfgang Scherzinger)

Figure 2b (bottom). Specimen of Sichuan Wood Owl *Strix uralensis davidi* from Lianhuashan reserve. Note the species-specific characters, such as the greyish facial disc, framed in dark brown with white perimeter spots, and the yellowish bill (Wolfgang Scherzinger)

streaking, a dark frame to the facial disc contrasting with a white-dotted perimeter and whitish stripe either side of the brown forehead (Fig. 2b). The latter pattern is atypical of most forms of Ural Owl *Strix uralensis* but occurs in Japanese *S. u. fuscescens* (Miyazaki 1990) and in Tawny Owl *S. aluco*.

In body size and morphology, Sichuan Wood Owl strongly recalls Ural Owl *S. u. liturata*, which also has coarse underparts streaking and almond-shaped blackish-brown eyes set within a distinct facial disc. However, the Chinese form is overall much darker, especially the blackish-brown scapulars. Furthermore, Sharpe (1875) noted the fine concentric lines in the facial disc, which he considered analogous to the pattern in Great Grey Owl *S. nebulosa*, and plain uppertail-coverts. Moreover, specimens have fine scribble-like markings on the central rectrices, which are uniformly dark, in contrast to the heavily barred outer feathers. Tail-feathers of other Ural Owl subspecies are dark brown, with 5–7 pale bars. Published illustrations are mostly based on specimens in Dresden and Berlin, sometimes incorrectly (Eck & Busse 1973, König *et al.* 1999, Holt *et al.* 1999, MacKinnon & Phillipps 2000).

Observations and methods

All field records were made in the main valley of Lianhuashan reserve, which stretches from a saddle at the base of Three Sisters peak in the west (at *c.*2,900 m, with dense old-growth coniferous forest on a steep slope, and dry meadows with scattered scrub and thorn bushes) to a swampy area beside a small creek in the east (with dense conifers and wet meadows, surrounded by thickets of willow). The eastern part also has steep slopes, with patchy bushes and young trees, interspersed by rocky areas and screes (2,850–3,000 m). On calm evenings owls could be heard over the full length of the valley, *c.*1.5 km. The entire area used by the pair measures a minimum 200 ha. In summary, over the three years, I made 14 acoustic and six visual records of the male, and three acoustic and four visual records of the female, but no confirmation of nesting was possible. My experiments concerning the responsiveness of Sichuan Wood Owl to a whistled imitation of the territorial song of Ural Owl demonstrated the owls to be generally highly responsive to the voice of the European bird, both when previously silent and when already engaged in territorial activity.

Vocal comparison of Ural Owl and Sichuan Wood Owl

Descriptions of the vocalisations of Sichuan Wood Owl are mostly rather unspecific, e.g. *kollol-kollol* (Weigold *in* Stresemann 1923), a barking *kbau-kbau* by the male and hoarse *kee-wi* uttered by the female (König *et al.* 1999) or an extended, tremulous howling (Hume & Boyer 1991), most of these authors emphasising the broad vocal conformity with Ural Owl. Sibley (1996) noted the similarity of the call notes with the Japanese subspecies *Strix u. fuscescens*, based on an observation by B. F. King.

Owls are suitable subjects for a taxonomic comparison of vocalisations, as they represent innate signals (see König 1994). Here, I compare the voice of Sichuan Wood Owl with the well-known repertoire of Ural Owl, as described by Scherzinger (1980) from field observations in eastern Slovakia (*S. u. macroura*), from tape-recordings of captive owls of Swedish origin (*S. u. liturata*) and more than 140 captive-bred owls released as part of a reintroduction project in the Bavarian Forest National Park (Germany).

The territorial song of male Ural Owl comprises three syllables. The first has two elements (*buhuu*, intonation at end) and is followed, after an interval of at least 1–2 seconds, by the second (of 3–4 elements, a short *buhulo*), and, shortly afterwards, by the third (a near-barking *buhu*, with up to four elements in quick succession: see Fig. 3). The sonogram of a typical, complete song of male Ural Owl reveals the duration of the strophe as 2.3 seconds (first syllable 0.4 seconds, second and third syllables 0.4 seconds each). The frequency of the softly ascending and descending elements of the first syllable is 0.200–0.510 kHz and the second and third at 0.220–0.600 kHz (with maximum amplitude 0.450 and 0.580 kHz: Table 1).

At first glance, strophic structure in the territorial song of Sichuan Wood Owl closely resembles that of Ural Owl (Fig. 3). The male's song comprises two syllables (lasting 1.08 seconds on average; N=3), but the first syllable consists of a

TABLE 1

The vocal repertoire of adult Ural Owl *Strix uralensis liturata* comprises 13 different vocalisations, of which most also occur in Sichuan Wood Owl *S. u. davidi* and are usually strikingly similar.

Vocalisation	***Strix u. liturata***	***Strix u. davidi***
begging by nestlings	*chjit, ki.szip*	?
territorial song	*buhoo.....buhulo..buhu*	*uhoo.....buhubub*
	(typical = trisyllabic)	(typical = disyllabic)
short-distance song—a	first syllables of song	first syllables of song
short-distance song—b	repeats last song elements	repeats last song elements
nest-site demonstration	rising scale (up to eight syllables)	rising scale (up to five syllables)
	bu.bu.bu.bu.bu....	*bu.bu.bu.bu....*
female contact	*kuwätt, kwä*	high-pitched *kuwäch*
begging		strident *kuwäck*
long-distance note	barking *guä, hwa, wu*	barking (*wu*)
alarm note	*kwäck, chwä*	shrill *kuwack*
aggressive note	crying *korah*	crying *korah*
aggressive song	serial *korah*	
	guo, chrooh	*guo*
soft contact call	growling	?
feeding note	rattling *tschrrt*	?
fear twitter	chirping *twitter*	
mating twitter	*twitter*	
defence	hissing	
instrumental note	bill-snapping	(probably)

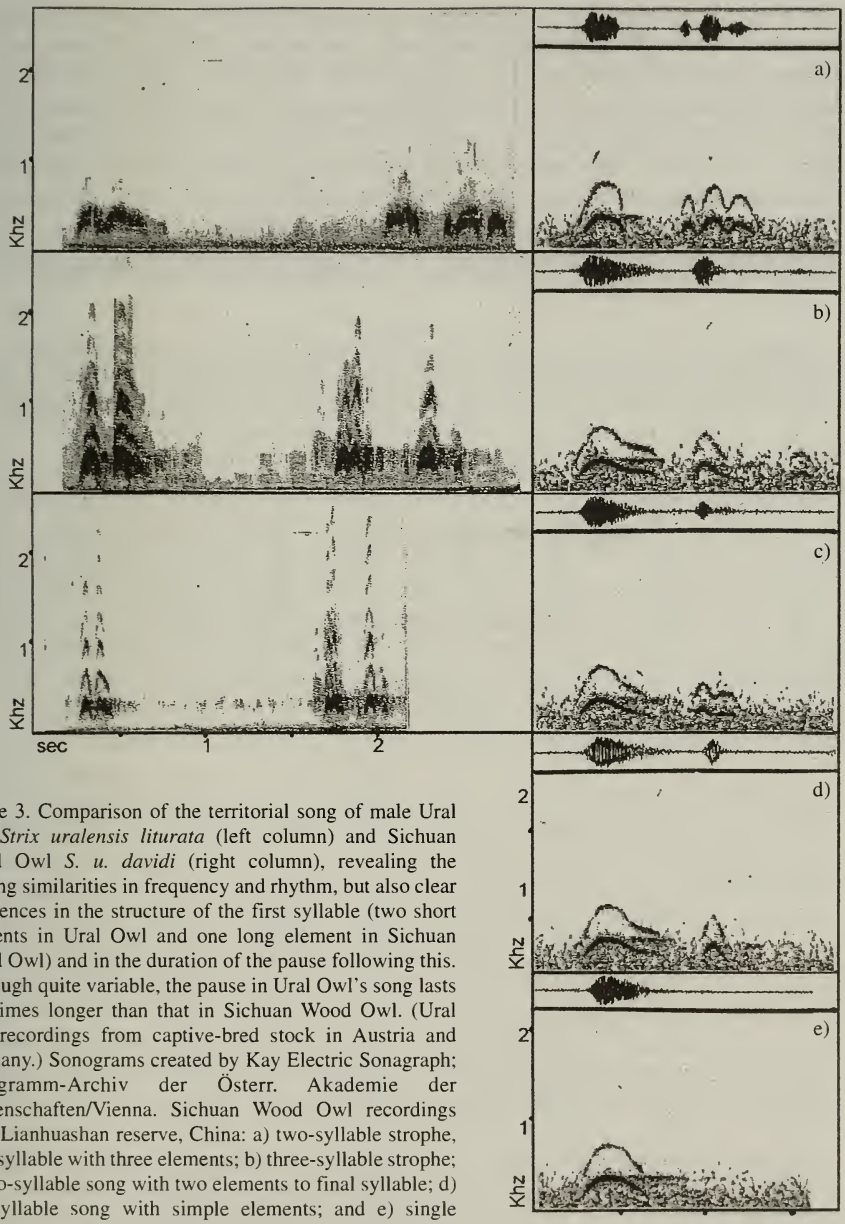

Figure 3. Comparison of the territorial song of male Ural Owl *Strix uralensis liturata* (left column) and Sichuan Wood Owl *S. u. davidi* (right column), revealing the striking similarities in frequency and rhythm, but also clear differences in the structure of the first syllable (two short elements in Ural Owl and one long element in Sichuan Wood Owl) and in the duration of the pause following this. Although quite variable, the pause in Ural Owl's song lasts 3–4 times longer than that in Sichuan Wood Owl. (Ural Owl recordings from captive-bred stock in Austria and Germany.) Sonograms created by Kay Electric Sonagraph; Sonagramm-Archiv der Österr. Akademie der Wissenschaften/Vienna. Sichuan Wood Owl recordings from Lianhuashan reserve, China: a) two-syllable strophe, final syllable with three elements; b) three-syllable strophe; c) two-syllable song with two elements to final syllable; d) two-syllable song with simple elements; and e) single syllable, repeated in soft and dull series. Sonograms created using Avisoft for PC, average intensity; H.-W. Helb (Univ. Kaiserslautern).

single element (a softly ascending and descending *uhoo*; duration 0.26–0.31 seconds). After a pause of just 0.34 seconds the second syllable of three elements follows (*buhubub*; duration 0.46–0.48 seconds). Frequency ranges at 0.207–0.390 kHz in the first and 0.213–0.370 kHz in the second syllable (centre of gravity 0.377 and 0.363 kHz, respectively; i.e. somewhat lower than in Ural Owl). Spontaneous song of the male usually was observed at the start of its daily activity, but mostly it called in response to my imitation of its song (e.g. on 4 and 7 May 1997 and 1 July 1999); singing occurred whilst roosting in the canopy or exposed on treetops, sometimes even in flight. In another type of territorial song, Sichuan Wood Owl

TABLE 2

Mean values for duration and frequency range of territorial song and nest-site demonstration in Ural Owl *Strix uralensis liturata* and Sichuan Wood Owl *S. u. davidi*: dt = overall duration of strophe, dt-1 = duration of syllable 1, dd-1 = duration of interval 1; df-1 = overall frequency of syllable 1, f-1a = max. frequency of syllable 1, f-1b = min. frequency of syllable 1, f-1max. = frequency of maximum power in syllable 1.

(means)	three syllables (*n*=3)	two syllables (*n*=3)	two syllables (*n*=5)	three syllables (*n*=4)	one syllable (*n*=8)	(means)	eight syllables (*n*=1)	4–5 syllables (*n*=11)
duration in sec								
dt-1	0.34	0.28	0.46	0.46		dt-1	0.09	
dd-1	1.27	0.34	0.25	0.2		dd-1	0.2	
dt-2	0.53	0.47	0.22	0.24				
dd-2				0.29		dd-7	0.1	
dt-3				0.18		dt-7	0.19	
dt	2.24	1.08	0.92	1.41	0.42	dt	1.6	1.35
frequency in kHz								
f-1a	0.497	0.39	0.386	0.375	0.375	f-1a	0.4	
f-1b	0.177	0.207	0.2	0.183	0.194	f-1b	0.12	
df-1	0.36	0.183	0.186	0.178	0.182	df-1	0.2	
f-1max	0.42	0.377	0.37	0.37	0.356	f-1max	0.3	
f-2a	0.56	0.37	0.284	0.343		f-3a		350
f-2b	0.2	0.213	0.186	0.185		f-3b		175
df-2	0.36	0.157	0.98	0.15				
f-2max	0.493	0.363	0.246	0.343		f-3max		347
f-3a				0.26		f-7a	0.5	
f-3b				0.17		f-7b	0.1	
df-3				0.9		df-7	0.3	
f-3max				0.26		f-7max	0.4	

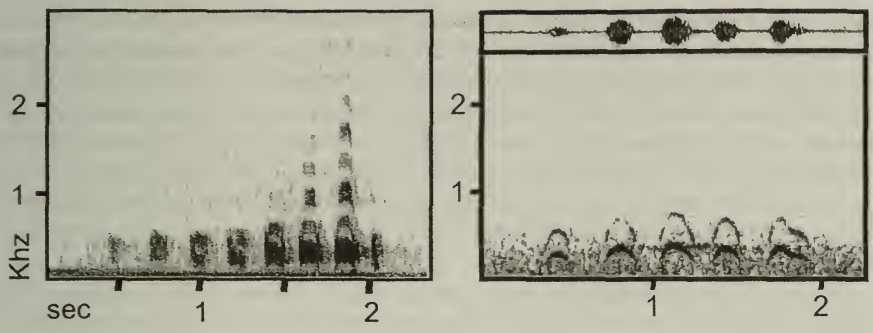

Figure 4. Nest-site demonstration in characteristic strophes of male Ural Owl *Strix uralensis liturata* (left) and Sichuan Wood Owl *Strix uralensis davidi* (right). Sonograms created using Avisoft for PC average intensity; H.-W. Helb (Univ. Kaiserslautern).

prolongs the first syllable (decreasing frequency; mean duration 0.46 seconds; *N*=5), when—to the human ear—it recalls the *bubo* call of Eagle Owl. After a short pause (0.22–0.28 seconds) the second syllable follows (1–2 elements, quickly subsiding; 0.15–0.27 seconds). The entire strophe of this song-type is shorter, lasting a mean 0.92 seconds, but frequencies are similar (see Table 2). A further variant song can be distinguished, which is virtually identical but with a third syllable like the second. The duration of the first syllable is 0.44–0.49 seconds, the next 0.20–0.29 seconds, but the third is somewhat shorter, at 0.13–0.24 seconds. The entire strophe lasts a mean 1.41 seconds (*N*=4), and frequencies are as in the second song-type.

Apart from varying the intervals, the male varies the strophes quite diversely, e.g. by repeating the first syllable alone (syllables soft and dull, at decreasing frequency) or repeating the last elements of the song twice. I observed such vocalisations in male Sichuan Wood Owl, especially in short-distance communication with the female. Concerning duration, structure and frequency, such softly ascending and extended syllables are like the first syllable of the second song-type (duration 0.42 seconds, frequency 0.194–0.375 kHz, with a mean centre of gravity at 0.356 kHz; *N*=8; Table 2). In certain situations, male Ural Owl also repeats the soft, rumbling notes of the first syllable of the territorial song or, less often, the second and/or third syllables separately (short-distance song in Table 1; given, e.g., in duet with the female, when offering prey or in pre-copulatory behaviour).

The close correspondence in vocalisations is also striking in the light rising scale of single notes that functions as nest-site demonstration in Ural Owl (Fig. 4). Indicating a high level of arousal, the male connects up to eight dull syllables of increasing length and intensity, with constant intervals (*bu.bu.bu.bu*; in a series of eight syllables the length of the shortest syllable was 0.09 seconds, of the longest

0.19 seconds; total strophe length 1.6 seconds). Because of this vocalisation's scale-like ascent, the frequency reaches 0.120–0.400 kHz in the first syllable, in the final one 0.100–0.500 kHz (and maximum intensity increases from 0.300 to 0.400 kHz). Male Sichuan Wood Owl also connects 4–5 syllables at regular intervals, the intensity softly increasing (*bu.bu.bu.bu*; Fig. 4). In 11 sonograms the mean duration of strophes is *c.*1.35 seconds (range 1.29–1.60 seconds), and the frequency ascends from 0.175 kHz, at the beginning of the strophe, to 0.350 kHz in the final, more vigorous syllable (maximum amplitude 0.340–0.350 kHz always occurs in the third syllable).

Moreover, the similarity in female contact calls in both owls is striking (see Table 1), at least to the human ear, as recordings of these calls are lacking. These calls may vary in their usage, from hoarse begging (a harsh *kuwätt* or high-pitched *kuwäch*) and a long sequence of grumbling *kwäch* to shrill warnings in sharp staccato (hard *kwäck* or strident *kuwack*). In both owls a shift from begging to alarm or even aggression is observable. Furthermore, Sichuan Wood Owl utters a shrill aggressive *korah* and *guo*, and probably a fierce barking, although I was unable to tape-record the latter. Such notes form the characteristic far-carrying calls uttered at the climax of territorial demarcation in Ural Owl.

Table 3 shows 13 different types of vocalisation known in Ural Owl, in comparison to eight types in Sichuan Wood Owl known to date. Given the striking similarity in their vocal repertoires, there seems little rationale from a vocal standpoint to regard Sichuan Wood Owl as anything other than a subspecies of Ural Owl.

Taxonomic status

Due to their high degree of specialisation as predators, mostly active in darkness, and with dull camouflaging colours, morphological variation is rather limited in many Strigidae. Similarities in size, appearance and feathering should therefore not be used alone to interpret phylogenetic relationships (König 1991). Instead, intraspecific comparisons should rely on as many characters as possible, including vocalisations, which given their function as an isolating mechanism in owls can be considered of great importance. Sichuan Wood Owl differs rather insignificantly from Ural Owl in its vocalisations, and the immediate reaction to an imitation of Ural Owl's territorial song by a male Sichuan Wood Owl—as to a conspecific rival—and to the imitation of nest-site demonstration by a begging female, suggests that even the complete isolation of *davidi* has not led to their separation, at least in vocalisations.

Based on Stresemann's suggestion (1923) that a male Sichuan Wood Owl from 'Hwanglungsze' represented a heavily pigmented form of *uralensis*, this owl has long been considered conspecific with *Strix uralensis*, and in Grossman & Hamlet (1964) was even relegated to merely a 'dark phase' of *S. uralensis*. The Chinese Red Data Book (Zheng Guangmei & Qishan Wang 1998), whilst acknowledging

the disjunct populations of *Strix uralensis*, nonetheless treated Ural Owl and Sichuan Wood Owl as conspecific. Both Holt *et al.* (1999) and Dickinson (2003) recognised the need for additional taxonomic studies of *davidi*, with the former electing to treat *uralensis* and *davidi* as members of a superspecies, and Dickinson (2003) as a single species. In contrast, König *et al.* (1999) accept *Strix davidi* as an independent species, pointing to its differing characteristics from the nearest subspecies of Ural Owl, *S. u. fuscescens* in Japan, especially the dark plumage and concentric facial disc pattern, as well as its isolated range, and in this they seem to have been followed by a number of other more recent authorities, e.g. Clements (2003). As to whether *davidi* should be ranked a species seems to depend on which characters are deemed to be most important, although a molecular analysis appears sorely needed.

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A new generic name for the Solitary Cacique

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The recent reconstruction of a molecular phylogeny of the Icteridae has changed our view of the evolutionary tree of the caciques and oropendolas (Price & Lanyon 2002, 2004). In particular, the caciques, until now entirely classified within the genus *Cacicus*, do not appear to represent a monophyletic grouping. Three separate lineages within this genus have been identified, some more closely related to oropendolas.

The position of Solitary Cacique *Cacicus solitarius* in the phylogenetic tree is entirely isolated from all other caciques, and closer to *Psarocolius* oropendolas. This result has not changed with the incorporation of new data into the molecular phylogeny (Price & Lanyon 2002, 2004), and therefore appears robust. According to Hellmayr (1937), the type species of *Cacicus* Lacépède is Red-rumped Cacique *Oriolus haemorrhous*, described by Linnaeus in 1766. Red-rumped Caciques are